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Dung beetles (Scarabaeidae, Scarabaeinae) of the Foothills–Andean Forest strip of Villavicencio, Colombia

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Abstract

We present a list of dung beetle species associated with the band of foothill–Andean transition forest found in the municipality of Villavicencio, Colombia. This section of forest is characterized by a heterogeneous landscape marked by anthropic activities such as livestock and agriculture. It is composed of a matrix of gallery or riparian forest relics, fragments of secondary high forest, and extensive open areas. We recorded 35 species in 17 genera of dung beetles. This list is presented with data on their distribution, ecological aspects, and habitat preferences, according to the abundance recorded during the study. Some altitudinal ranges were expanded. In addition to emphasizing the importance of completing the lists of species of interest areas, such as the Foothills–Andean Forest strip in the eastern mountain range of Colombia. Finally, some considerations were discussed to improve the study and increase our knowledge of Colombian dung beetles.

Keywords

Biodiversity, Llanos Orientales, North Andes, Orinoquia, Scarabaeinae distribution, secondary forests.

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Introduction

The band of Andean and lowland foothills are two life zones highly impacted by human activities, principally livestock, urban development, crops, and other activities (Correa et al. 2005; Rodríguez et al. 2006; Escobar et al. 2007). These activities have resulted in contrasting and heterogeneous landscapes, forest relics, and riparian forests immersed in a matrix of agriculture and/or peri-urban activities (Fahrig 2003). These types of activities differentially affect the biodiversity, which faces constant threats because of its high vulnerability. Such activities can lead to a process of local extinctions (Minorta-Cely and Rangel-Ch 2014a), which generally leads to a loss of ecological function and later, to the detriment of ecosystem services (Wilcove et al. 1986; Fahrig 2003), mainly for those faunal groups that are highly sensitive to environmental alterations, such as dung beetles (Spector 2006).

In Colombia, great efforts have been made to acquire knowledge about dung beetles (Escobar 2000; Noriega et al. 2013, 2015), though such research has been in specific regions. This, more than being a problem, poses a challenge and draws attention to a wide range of issues. A country with such great diversity of ecosystems and life zones (Andrade-C 2011) must continue to join forces in

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the documentation and monitoring of biodiversity in the larger part of the national territory. In this way, decisions taken regarding this documentation and monitoring will be sufficiently discussed to allow coordinated conservation actions that would have a lower impact on the biodiversity (Niemelä 2000; MADS 2012).

Dung beetles are a group widely used in ecological assessments (Spector 2006; Noriega et al. 2007; Otavo et al. 2013). In addition to being recognized as an ideal taxonomic group for biodiversity analysis (Halffter and Favila 1993), their crucial participation in different basic processes of terrestrial ecosystems (Spector 2006; Nichols et al. 2007) makes them a group of organisms of extreme importance for maintaining ecosystem functions. Among these functions, secondary seed dispersal, soil aeration, and soil nutrient reincorporation are highlighted (Nichols et al. 2008; Almeida et al. 2011; Nunes et al. 2016).

Taking into account the changing landscapes in the Andean and lowland foothills area and the importance of dung beetles in terrestrial ecosystems, it is important to study the assemblage structure of dung beetles (Coleoptera: Scarabaeinae) that is present in order to direct further efforts for understanding their functional diversity patterns. Therefore, the objective of this research is to build a list of dung beetles that inhabit the Andean–foothills forest strip, including some aspects of their biology as well as data on their distributions in the department of Meta, Colombia.

Methods

This research was carried out in the Vereda El Carmen and Buenavista (Foothills–Andean forest transition area), in the municipality of Villavicencio, Meta, Colombia, at an elevation of between 750–1000 m a.s.l. (Fig. 1). This region is characterized by a vegetation dominated by forests of *Cassia moschata* Kunth. In this type of forest, the canopy is about 21 m with some trees that manage to reach heights of up to 30 m (Rangel-Ch 2014). In addition, the history of intervention in this area is highlighted, where mosaics of regenerated secondary vegetation were observed. Minorta-Cely and Rangel-Ch (2014b) defined this part of the Orinoco region within the climatic group G with high amounts of annual precipitation (> 3000 mm) with a very humid and rainy climate and a two-season unimodal rainfall distribution pattern. The average annual rainfall is 3766 mm with a monthly average of 313 mm. The highest concentration of precipitation occurs from April to October while December to February are the driest months.

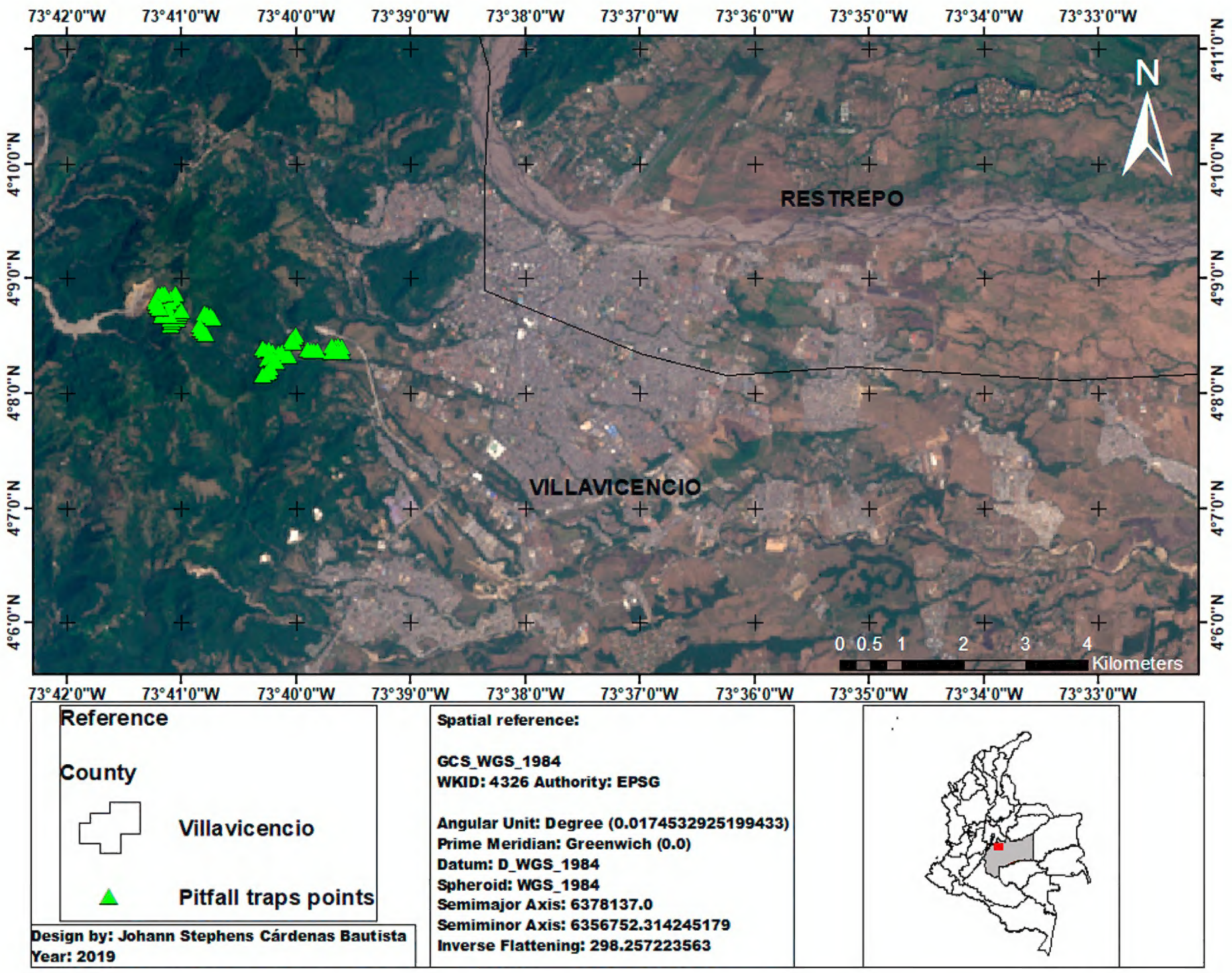

Figure 1. Map of the sampling site between in the Veredas Buenavista and El Carmen, Villavicencio, Meta.

Sampling and research design. Four types of predominant land uses in the area were identified: i) High secondary forests (native forests in regeneration, with few primary elements included); ii) Gallery or riparian forest relics (relictual forests that have regenerated or survived along watercourses such as rivers or streams); iii) Wooded pastures (derivative vegetation, non-native, resulting from the deforestation of the natural ecosystem); and iv) Open pastures (non-native grassland, resulting from the total deforestation of the native vegetation). In each element or type of terrain two linear transects were established, each 150 m long in which four pitfall traps per transect (eight in total) were arranged. This number of traps were established according to the available area for each land use and accessibility. Transects were separated from each other by 100 m and the traps were separated by 50 m along each transect. Distances guaranteed the independence of the samples (Larsen and Forsyth 2005; Noriega and Fagua 2009).

Four sampling events were carried out, each with a duration of 12 days; and these covered the climatic fluctuations that occur in the area throughout the year (two sampling events during the season of greater rainfall and two during the season of less rainfall). Individuals were collected with pitfall traps baited with approximately 50 g of fresh human dung, protected by a 15 × 10 cm tulle mesh and fastened with a thin rope. Each pitfall trap was made from a plastic container (16 oz.) buried at ground level, which contained water-industrial liquid detergent-salt mixture (to kill and preserve the specimens when the sample fell into the trap). A wooden stick 20–30 cm long containing the armed bait was suspended over the mixture. The traps were active for 48 hours to guarantee a representative sample of the study sites (Noriega and Fagua 2009; da Silva and Hernández 2015). The specimens were collected from the traps every 24 hours, deposited in hermetically sealed bags, and labeled with information about the trap, the transect, and the type of vegetation cover.

Laboratory phase. Specimens were identified using specialized taxonomic keys by Génier (1996), Edmonds (2000), Génier (2009), Edmonds and Zideck (2010), Vaz-de-Mello et al. (2011) and Edmonds and Zideck (2012). The identified material was also compared to reference specimens in the entomological collection of Museo de Historia Natural "Luis Gonzalo Andrade" Universidad Pedagógica y Tecnológica de Colombia (UPTC), Colección de Escarabajos Coprófagos de Colombia-Colección Alejandro Lopera Toro (CECC-CALT), and the collection of dung beetles of the Instituto de Investigación de Recursos Biológicos "Alexander Von Humboldt" (IAVH). We included ten morphospecies (e.g., *Onthophagus* sp. 2), since they were reviewed, verified, and compared in the biological collections, with the literature available for the study area and with the concept of specialists in the taxonomic group, which supports the decision to leave them as different taxonomic entities. The inclusion of these taxa allows us to have specimens for subsequent taxonomic and systematic reviews, in addition to show data on the high richness found in the sampling area.

Based on the definition of rare species based on their abundance (Moreno 2001; Jain et al. 2014) and the ordering carried out by Neita and Escobar (2012), we categorized the species for this study as follows: Rare (<100 individuals), Abundant (between 100 and 1,000 individuals) and Very abundant (>1000 individuals).

In addition, the abundance by counting individuals for each species for each examined trap was estimated, and the dung beetle guilds was recognized. The tunneler guild, species bury dung balls in vertical chambers in close proximity to original deposition site; the rollers guild are a species transport balls some horizontal distance away, before burial in the soil surface; finally, the dwellers guild, species feed and brood their young inside the dung mass itself. The collected samples were examined under macro stereoscope (Leica 9i) photography equipment. Also, the mean body length of the examined specimens was recorded. The terminology on external morphology for dung beetles used for the identification of species and morphospecies was based on the coleopteran work of Lawrence et al. (2010, 2011) and Edmonds (1972).

Results

In this study we recorded 35 species of dung beetles, distributed in 17 genera. The resulting dataset has been registered in GBIF (Cárdenas-Bautista et al. 2020). Twenty-five species belong to the tunneler guild, followed by rollers with six species, and four species were dwellers. The riparian forest relics was the highest values with 31 species and 2,859 individuals. This was followed by wooded pastures with 27 species and 1,085 individuals. The high secondary forest had 23 species and 2,412 individuals. Finally, the open pastures had 18 species and 912 individuals (Table 1). The presence of rare species such as *Bdelyrus metaensis* Cook, 1998, *Pseudocanthon* sp. 1 and *Scybalocanthon* aff. *kelleri* Pereira & Martinez, 1956 were noted (Table 1). Other species that are widely distributed throughout the mountain range, but with low abundance were rare in this study: *Anisocanthon villosus* Harold, 1868, *Ateuchus* cf. *aenomicans*, *Coprophanaeus telamon* (Erichson, 1847), *Deltochilum guildingii* (Westwood, 1835), *Deltochilum orbiculare* Lansberge, 1874, *Dichotomius boreus* (Olivier, 1789), *Dichotomius mamillatus* (Felsche, 1910), *Dichotomius compresicollis* (Luederwaldt, 1929), *Dichotomius nisus* (Olivier, 1789), *Eurysternus mexicanus* Harold, 1869, *Ontherus kirschii* Harold, 1867, *Phanaeus cambeforti* (Arnaud, 1982), *Phanaeus haroldi* Kirsch, 1871, *Scatimus strandi* Balthasar, 1939 and *Sulcophanaeus auricollis* (Harold, 1880); and specifically for the study area, the morphospecies *Canthidium* sp. 3 and *Onthophagus* sp. 2 (Table 1).

Below, a description of some of the most typical

aspects regarding the distribution and biological observations of these species can be found:

Superfamily Scarabaeoidea
Family Scarabaeidae
Subfamily Scarabaeinae
Tribe Deltochilini
Anisocanthon Martínez & Pereira, 1956

Anisocanthon villosus (Harold, 1868)

Materials examined. COLOMBIA • 4, 5.60 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′24.60″N, 073°39′40.89″ W; 648 m a.s.l.; 18 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; open pasture; Crplt4; UPTC-In-00018. • 1♀, 5.60 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′21.97″N, 073°39′48.60″W; 672 m a.s.l.; 29 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Crpat8; UPTC-In-00019.

Identification. This species can be distinguished from other *Anisocanthon* species by the bidentate clypeus with a pair of protuberances between the eyes; lateral edge of the pronotum angled towards its anterior medial parts; reddish to copper body with golden and strong setae from head to pygidium in the dorsal view (Harold 1868a).

Distribution. This species is widely distributed. It has been found in Venezuela, Colombia, Ecuador, Peru, Bolivia, Argentina, and Paraguay (Pereira and Martínez 1956). In Colombia it is known from the department of Meta (Medina et al. 2001). This species is associated with disturbed habitats, found in forest remnants, gallery forests, forest edges and cattle pastures with grasses of variable height. The beetles were previously recorded in areas of up to 650 m a.s.l., and for this study area they were found at heights above 700 m a.s.l. This species was rare in the area (55 individuals), and it was mostly found in grasslands that were used for cattle grazing.

Canthon Hoffmannsegg, 1817

Canthon cyanellus Leconte, 1859

Materials examined. COLOMBIA • 5, 8.29 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′22.73″N, 073°39'39.53″W; 692 m a.s.l.; 29 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture, Crpat5; UPTC-In-00020.

Identification. This species can be distinguished from other *Canthon* species by the circular body with a wide range of coffee colors in the pronotum, elytra and pygidium, although it is predominantly black; quadridentate clypeus.

Distribution. This species has been recorded in the United States, Central America, Colombia and Venezuela (Vulcano and Pereira 1964). In Colombia, it is known from the departments of Bolívar, Meta, and Tolima, between 100–300 m a.s.l. (Medina et al. 2001; Medina and Pulido 2009; Arias-Buriticá et al. 2011). In the study area, it was observed in interposed relicts of riparian forest, in wooded pastures and open pastures between 650–750 m a.s.l. It was an abundant species (207 individuals). There was an ample preference for open areas, where we obtained records of 206 individuals.

Deltochilum Eschscholtz, 1822

Deltochilum (*Deltohyboma*) sp. 1

Materials examined. COLOMBIA • 4, 11.91 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Manigua" Farm; 04°08′17.85″'N, 073°40′14.57″W; 803 m a.s.l.; 27 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Crbt1; UPTC-In-00021. • 3, 11.91 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′21.8″N, 073°40′12.1″W; 774 m a.s.l.; 16 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest relics; Crbrt4; UPTC-In-00022.

Identification. This morphospecies can be distinguished from other *Deltochilum* species by having a copper to dark gray body; elytra interestriae with strongly marked ocellated points; presence of carina towards the anterior external edge of the elytra (pers. obs.).

Distribution. By reviewing collections this morphospecies has been observed for Colombia from a large part of the lowland foothills to some areas of Andean forests. This abundant morphospecies (341 individuals) was found between 700–1100 m a.s.l., and recorded in all sampled areas (wooded pasture, gallery or riparian forest and high secondary forest). A preference was observed for forest cover (263 individuals).

Deltochilum guildingii (Westwood, 1835)

Materials examined. COLOMBIA • 1, 28.22 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Loma" Farm; 04°08′30.69″N, 073°40′00.06″W; 729 m a.s.l.; 29 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; CrPat1; UPTC-In-00023. • 1, 28.22 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′19.90″N, 073°40′04.15″W; 744 m a.s.l.; 16 Feb. 2019; riparian forest; Cárdenas Johann and Parada Jenny leg.; Crbrt8; UPTC-In-00024.

Identification. This species can be distinguished from other closely related *Deltochilum* species such as *D. molanoi*, *D. lovipes*, and *D. loperae* by the lateral medial angle of the rounded pronotum; pronotal margin sinuous between medial lateral and posterior angle; elytra interstriae with bright calluses on the central third (González-Alvarado and Vaz-de-Mello 2014).

Distribution. In Colombia, it has been found in the departments of Bolívar, Cesar, Magdalena and Meta. It has been observed between 100–1200 m a.s.l. (González-Alvarado and Vaz-de-Mello 2014). This rare species was observed at 760 m a.s.l. within the sampling area, and was only found a few times within the riparian forest (three individuals) and wooded pasture (two individuals).

***Deltochilum orbiculare* Lansberge, 1874**

Materials examined COLOMBIA • 1, 27.86 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′22.73″N, 073°39′53.50″W; 692 m a.s.l.; 15 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Crpat5; UPTC-In-00025. • 2, 27.86 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Manigua" Farm; 04°08′09.54″N, 073°40′16.92″W; 918 m a.s.l.; 29 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Crbt8; UPTC-In-00026.

Identification. This species can be distinguished from other *Deltochilum* by the head with a dorsal carina, with sharp and divergent clypeal teeth; well-marked deep cephalic scoring over the entire surface; the ninth interstria of the pseudo eplipleuron with a keel that exceeds half of the elytra and is not visible dorsally in the posterior part of the interstria; presence of subcircular dimpled interstriae and bright and raised irregular areas (González et al. 2009).

Distribution. It is known in Colombia from the departments of Amazonas, Bolívar Caquetá, Cundinamarca, Guaviare, Meta, Nariño and Putumayo. There are records between 60–1200 m a.s.l. in mainland or gallery forests (González et al. 2009). In riparian and high secondary forests between 850–950 m a.s.l. within the study area, nine specimens in riparian forest and 15 specimens were captured in high secondary forest, and only one individual was collected in wooded pasture.

Pseudocanthon Bates, 1887

***Pseudocanthon* sp. 1**

Materials examined. COLOMBIA • 1♀, 4.21 mm; Meta, Villavicencio, Vereda Buenavista, "El Triunfo" Farm; 04°08′51.42″N, 073°41′11.66″W; 1218 m a.s.l.; 25 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; open pasture; Bvplt4; UPTC-In-00027.

Identification. This morphospecies can be distinguished from other Deltochilini species by its small size; quadridentate clypeus; ovoid, elongated, and flattened body; tarsal nails angled basally (pers. obs.).

Distribution. In the Colombian Orinoquian lowlands the morphospecies was observed in open pasture habitat. However, this rare morphospecies only one individual was recorded, which makes it rare for the sampling that was carried out.

Scybalocanthon Martínez, 1948

***Scybalocanthon* aff. *kelleri* Pereira & Martínez, 1956**

Figure 2A

Materials examined. COLOMBIA • 2♂, 2♀, 8.025 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′40.92″N, 073°41′09.97″W; 1148 m a.s.l.; 23 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt8; UPTC-In-00028.

Identification. This species can be distinguished from other *Scybalocanthon* species such as *S. aereus* and *S. sexspilotus* by the head, pygidium and evenly colored femurs (Silva and Valois 2019); variable coloration in the pronotum from light brown to dark spot patterns. The collected specimens of *Scybalocanthon* aff. *kelleri* showed the usual pattern of completely dark coloration on the femur as described by Silva and Valois (2019). However, in some individuals this pattern varied with a light medial coloration and dark ends.

Distribution. This species is closely related to *S. kelleri*, recorded from the Eastern Cordillera of Colombia, in the department of Meta at 200 m a.s.l. (Medina and Pulido 2009). In the study area, this species was associated with riparian forests and was found at an altitude of 1000 m a.s.l. Four individuals were collected, which categorizes it as a rare species.

Tribe Phanaeinii
Coprophanaeus Olsoufieff, 1924

***Coprophanaeus telamon* (Erichson, 1847)**

Materials examined. COLOMBIA • 1♀, 23.1 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Triunfo" Farm; 04°08′44.51″N, 073°41′11.35″W; 1179 m a.s.l.; 13 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; open pasture; Bvplt8; UPTC-In-00029. • 1, 23.1 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′40.92″N, 073°41′09.97″W; 1207 m a.s.l.; 14 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt1, UPTC-In-00030. • 1♀, 23.1 mm (mean); Meta, Villavicencio, Caño Blanco–Caño Buque; 04°08′21.08″N, 073°40′08.76″W; 761 m a.s.l.; 27 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Crbrt5; UPTC-In-00031.

Identification. This species can be distinguished from other *Coprophanaeus* species by the base of the male head horn, which is usually more or less quadrate, with sides more or less parallel or slightly divergent, and lateral angles tuberculate; the central process is long or longer than the base and is usually strongly and angularly bent posteriorly, the angle itself is often conspicuously bituberculate, the central process (viewed laterally) strongly inclined posteriorly, and the tip usually lying well posterior to the line connecting the lateral tubercles (Edmonds and Zídek 2010).

Distribution. In Colombia, it has been recorded from the departments of Amazonas, Boyacá, Caquetá, Guainía, Guaviare, Meta, Norte de Santander, Putumayo and Vaupés at elevations below 1500 m a.s.l. along the eastern slope of the Eastern Cordillera (Edmonds and Zideck 2010). For our study area, it was observed between 700–1200 m a.s.l., and so it was reported as a rare species (19 individuals). It was collected in all the habitats selected for sampling: high secondary forest (five individuals), riparian forest relics (nine individuals), open areas of wooded pastures (four individuals) and open pastures

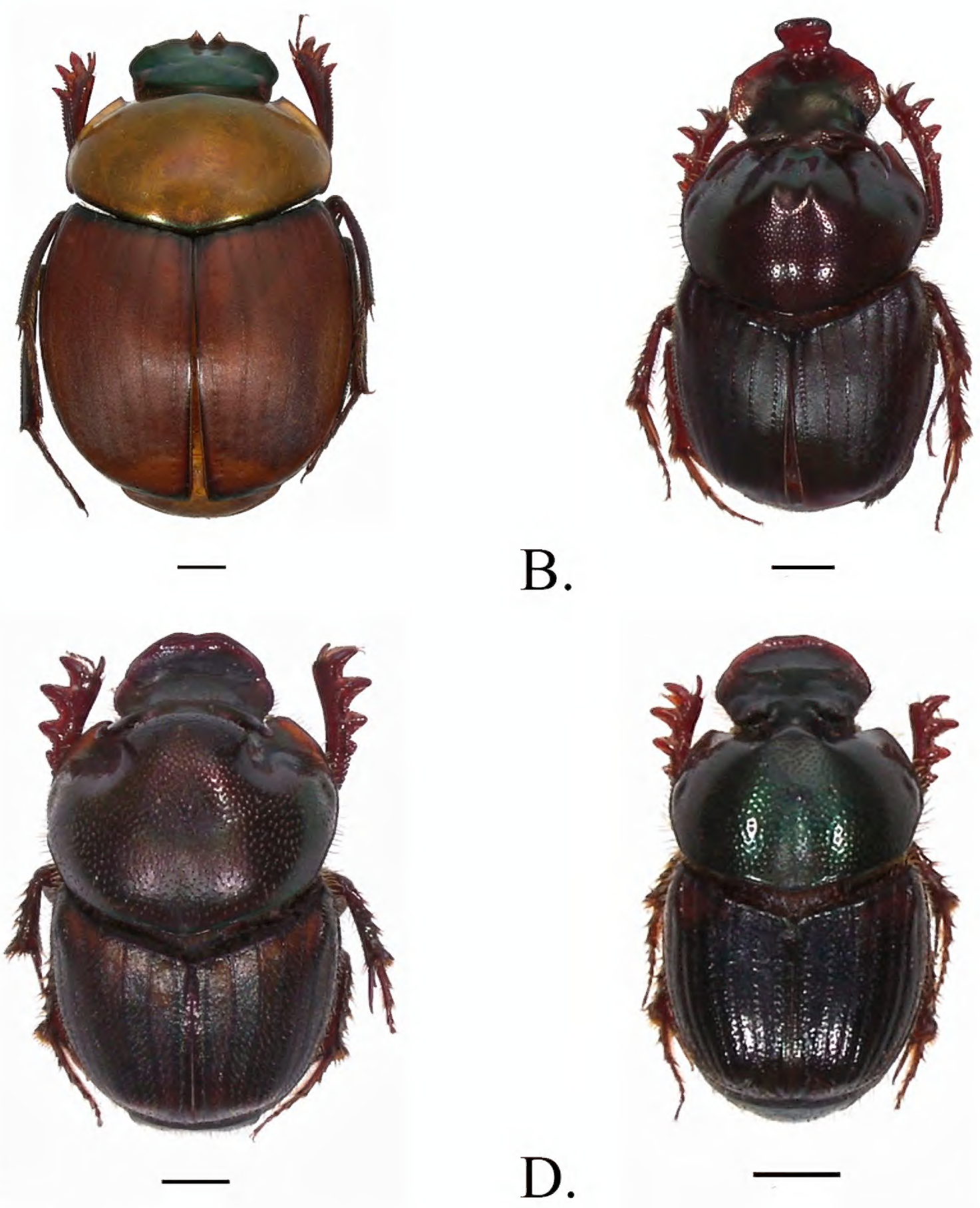

Figure 2. Species of dung beetles. **A.** *Scybalocanthon* aff. *kelleri* Pereira & Martínez, 1956. **B.** *Onthophagus* gr. *clypeatus* Blanchard, 1843. **C.** *Onthophagus* sp. 1. **D.** *Onthophagus* sp. 2. Scale bars = 1 mm.

with one individual.

Phanaeus MacLeay, 1819

***Phanaeus cambeforti* Arnaud, 1982**

Materials examined. COLOMBIA • 1, 14.52 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′41.97″N, 073°40′47.92″W; 1177 m a.s.l.; 12 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt1; UPTC-In-00032. • 1♂, 14.52 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Manigua" Farm; 04°08′09.54″N, 073°40′16.92″W; 918 m a.s.l.; 27 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Crbt8; UPTC-In-00033. • 2, 14.52 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Loma" Farm; 04°08′30.69″N, 073°40′00.06″W; 729 m a.s.l.; 15 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Crpat1; UPTC-In-00034.

Identification. This species can be distinguished from other *Phanaeus* species by the pronotal punctures, while these were not strong, they usually are distinct both on the sides and on the disc; the pronotal central micro spots were often difficult to detect (×40) and were absent in some specimens; the basal pronotal fossae was lacking or represented only by small punctures (×10); the dorsum was olive green or olive brown with metallic highlights on the pronotum and the pygidium was green (Edmonds and Zidek 2012).

Distribution. For the Orinoco region there are records from 200–600 m a.s.l. (Medina and Pulido 2009). In the study area, the species was found between 700–950 m a.s.l. *Phanaeus cambeforti* was rare species (58 individuals) and was collected both during the dry season and in the rainy season with a greater habitat preference for areas with vegetation cover such as high secondary forest (43 individuals), riparian forest relics (four individuals),

unlike open areas such as wooded pasture where only 11 individuals were recorded.

Phanaeus haroldi Kirsch, 1871

Materials examined. COLOMBIA • 1♂, 20.49 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′38.74″N, 073°41′05.29″W; 1172 m a.s.l.; 25 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Bvpat7; UPTC-In-00035. • 2, 20.49 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Triunfo" Farm; 04°08′44.51″N, 073°41′11.35″W; 1179 m a.s.l.; 23 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; open pasture; Bvplt8; UPTC-In-00036. • 1, 20.49 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′20.61″N, 073°40′05.71″W; 751 m a.s.l.; 16 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Crbrt7; UPTC-In-00037.

Identification. This species can be distinguished from other *Phanaeus* species by the large cephalic horn of the male that is erect, slender, and not distinctly swollen on the posterior side; the large pronotal horns of the male are curved anterodorsally, separated by an oval concavity whose posterior margin is weakly and broadly raised transversely; the anteromedial pronotal concavity of female is flanked by a pair of dorsally directed, apically convergent, blade-like projections (tooth-like in small individuals) (Edmonds and Zídek 2012).

Distribution. In Colombia it has been recorded in Boyacá, Caquetá, Casanare, Guaviare, Huila, Meta and Putumayo (Medina et al. 2001; Medina and Pulido 2009; Noriega et al. 2009), between 50–600 m a.s.l. It is distributed both in the humid montane forest and in the foothills of the Eastern Cordillera. In the study area, this rare species (44 individuals) was observed between 700–1000 m a.s.l. The beetles were found in wide areas of open pasture (16 individuals), wooded pasture (25 individuals) and in the riparian forest relics (three individuals).

Sulcophanaeus Olsoufieff, 1924

Sulcophanaeus auricollis (Harold, 1880)

Materials examined. COLOMBIA • 1♀, 23.3 mm; Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′49.33″N, 073°41′05.32″W; 1152 m a.s.l.; 25 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt5; UPTC-In-00038.

Identification. This species can be distinguished from other *Sulcophanaeus* species by the small pronotum, completely and densely dotted and roughened more strongly towards the edges, in developed males this character is weak, showing smooth micro punctures on the disc and the pronotal surface with metallic coloration; pygidium is usually fully colored like the pronotum but in some specimens it is only partial, from bright metallic red, reddish green, or dark emerald green (Edmonds 2000).

Distribution. This species is distributed in Colombia in the departments of Boyacá, Casanare, Cundinamarca and Meta, at elevations between 250–750 m a.s.l. (Edmonds 2000). Within the study area, one individual was collected in the riparian forest relics, defining its condition as a rare species associated with the time of greatest rainfall.

Tribe Ateuchiini
Ateuchus Weber, 1801

Ateuchus cf. *aenomicans*

Materials examined. COLOMBIA • 1, 4.74 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′21.52″N, 073°39′37.54″W; 648 m a.s.l.; 28 Apr. 2019; Cárdenas Johann and Parada Jenny leg., Open pasture; Crplt5; UPTC-In-00039. • 4, 4.74 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Loma" Farm; 04°08′30.69″N, 073°40′00.06″W; 729 m a.l.s 27 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; wooded pasture; CrPatl; UPTC-In-00040.

Identification. This species can be distinguished from other *Ateuchus* species by the oval and compact body, smooth head that is slightly rough towards the front, clipped carapace, the pronotum with individual punctation grouped towards the anteromedial border (Harold 1868b).

Distribution. This species is distributed in Brazil, Colombia, Costa Rica, Ecuador and Panama and is common in gallery forests, uncommon in mainland forests, floodplains and secondary forests, with an altitudinal distribution up to 800 m a.s.l. For the study area, we observed that this species could move interchangeably between wooded areas and wooded grasslands, between 700–850 m a.s.l. *Ateuchus cf. aenomicans* is a rare species (60 individuals) and its greatest abundance was recorded in wooded pastures (33 individuals), followed by the high secondary forest (16 individuals) and riparian forest relics (10 individuals).

Bdelyrus Harold, 1869

Bdelyrus metaensis Cook, 1998

Figure 3A

Materials examined. COLOMBIA • 1♀, 8.2 mm; Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′49.33″N, 073°41′05.32″W; 1147 m a.s.l.; 25 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt7; UPTC-In-00041.

Identification. This species can be distinguished from other *Bdelyrus* species by having a strong and dense scoring throughout the body. The females are moderately carapaced towards the anterior part of the body and the apex of the clypeus margined (Cook 1998).

Distribution. This specimen is known only from the record used for the description, located in Villavicencio, between 100–350 m a.s.l. (Cook 1998; Medina and

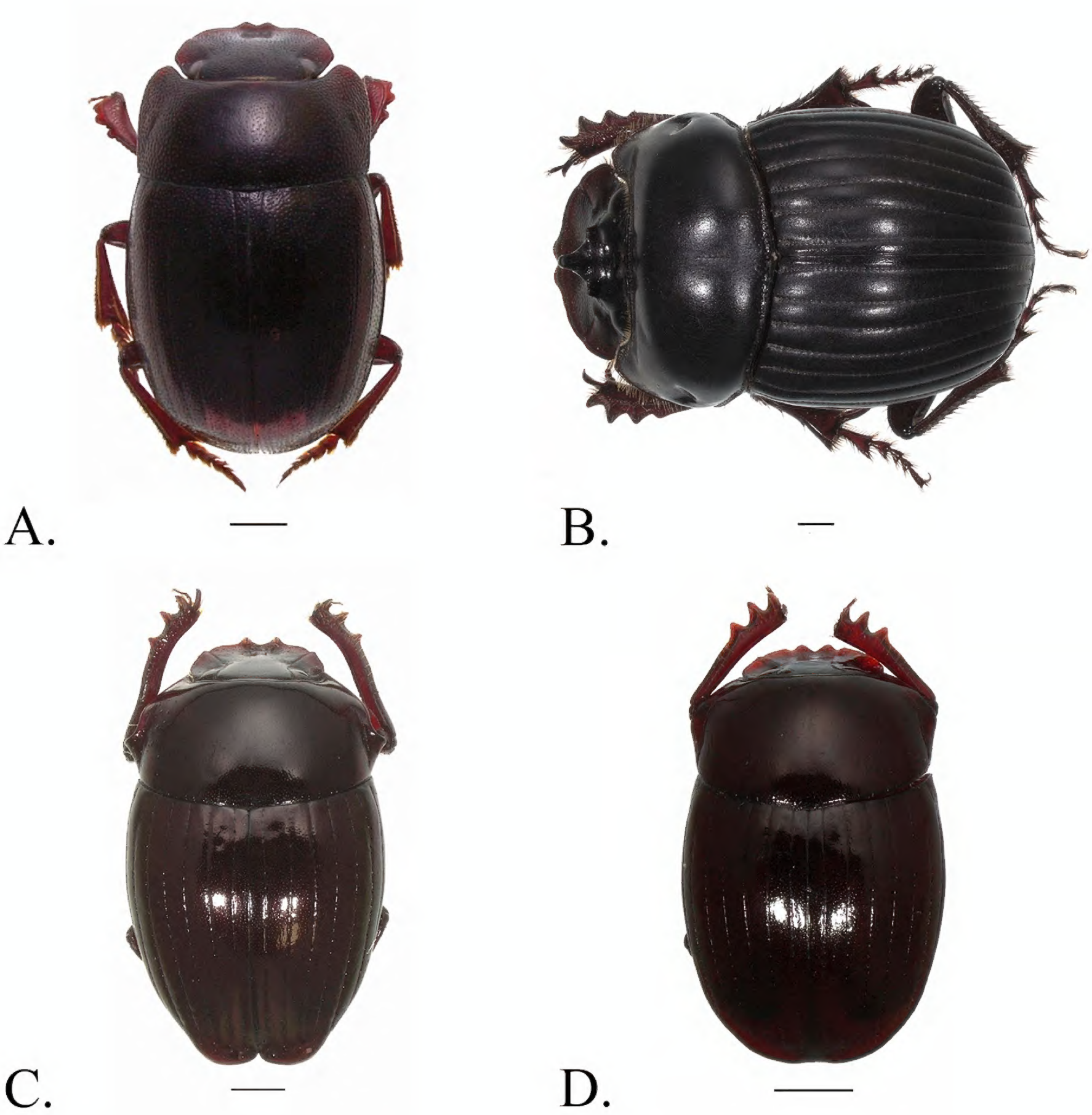

Figure 3. Species of dung beetles. **A.** *Bdelyrus metaensis* Cook, 1998. **B.** *Dichotomius tristis* (Luederwaldt, 1923). **C.** *Uroxys* sp. 1. **D.** *Uroxys* sp. 2. Scale bars = 1 mm.

Pulido 2009). In the area, one individual was recorded throughout the sampling and was collected in the riparian forest relics between 1000–1100 m a.s.l.

Canthidium Erichson, 1847

***Canthidium* sp. 1**

Figure 4A

Materials examined. COLOMBIA • 1♀, 4.75 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′38.68″N, 073°41′02.25″W; 1201 m a.s.l.; 26 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Bvpat1; UPTC-In-00042. • 4, 4.75 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′30.94″N, 073°40′47.30″W; 1067 m a.s.l.; 11 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt8; UPTC-In-00043.

Identification. This morphospecies can be distinguished from the other morphospecies of collected *Canthidium* by the three cephalic protuberances on the head; a smooth pronotum with metallic coloration; elytra striae strongly excavated; and the body varied in its coloration from reddish, green, shiny black (pers. obs.).

Distribution. In the study area the morphospecies was found from 700 to 1200 m a.s.l. It is an abundant morphospecies (748 individuals). Although this morphospecies manages to move between the areas of study, from cattle pastures to forest cover, the highest abundance values were found in the forest cover areas (727 individuals).

***Canthidium* sp. 2**

Figure 4B

Materials examined. COLOMBIA • 1, 5.28 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El

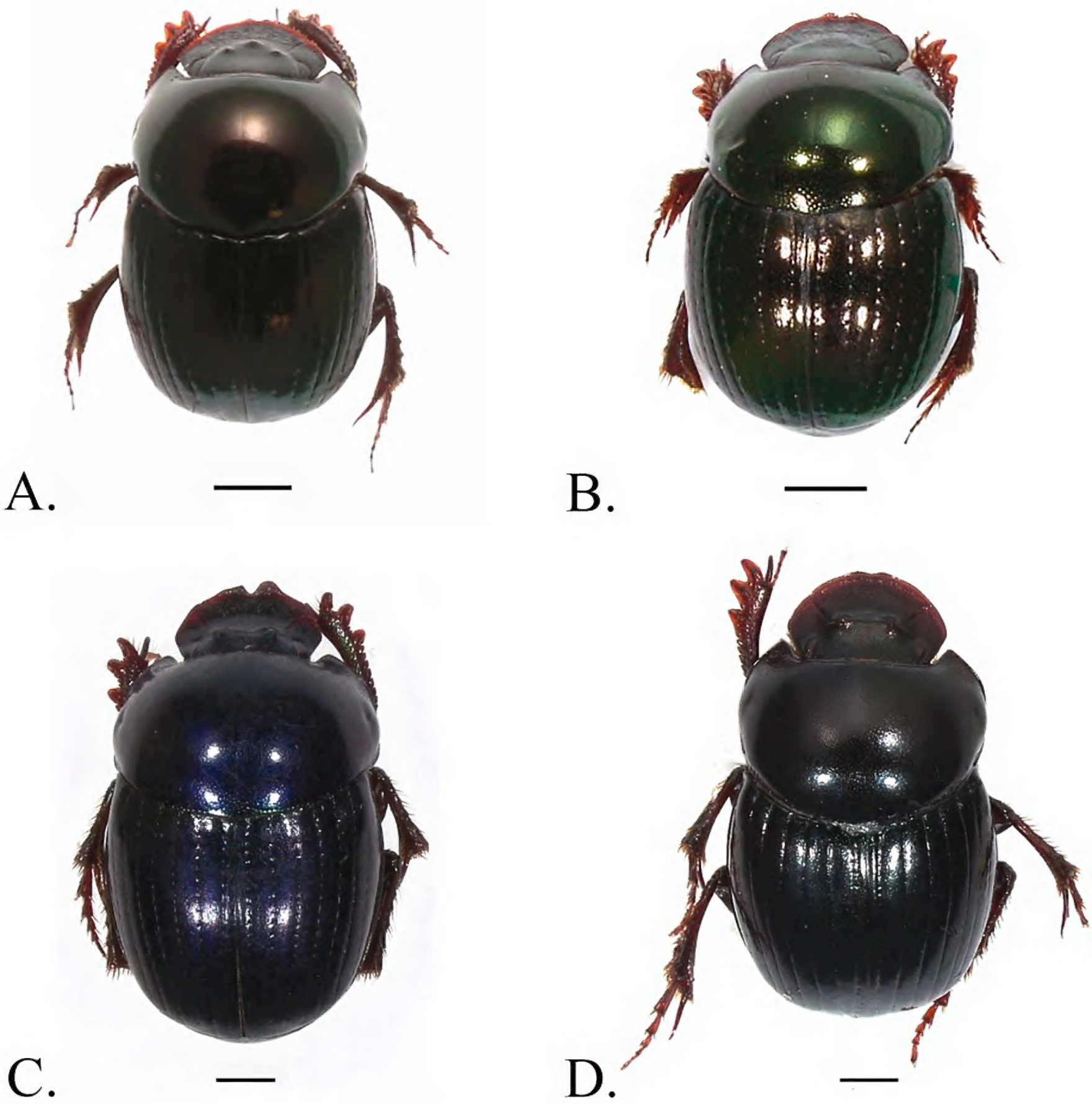

Figure 4. Species of dung beetles. **A.** *Canthidium* sp. 1. **B.** *Canthidium* sp. 2. **C.** *Canthidium* sp. 3. **D.** *Canthidium* sp. 4. Scale bars = 1 mm.

Porvenir Farm; 04°08′42.33″N, 073°41′09.20″W; 1147 m a.s.l.; 24 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt7; UPTC-In-00044. • 4, 5.28 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′32.33″N, 073°40′48.44″W; 1095 m a.s.l.; 12 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt7; UPTC-In-00045.

Identification. This morphospecies can be distinguished from the other morphospecies of collected *Canthidium* by the smooth head without protuberances or cephalic horns; body varied in its coloration from reddish, green, black and shiny (pers. obs.).

Distribution. In the study area, the morphospecies was found from 700 to 900 m a.s.l., where 188 individuals were found. Like *Canthidium* sp. 1, was observed throughout the study areas and shows a preference for forest habitats (178 records).

***Canthidium* sp. 3**

Figure 4C

Materials examined. COLOMBIA • 1, 7.20 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′49.33″N, 073°41′05.32″W; 1174 m a.s.l.; 10 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt3; UPTC-In-00046. • 1, 7.20 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′19.90″N, 073°40′04.15″W; 744 m a.s.l.; Cárdenas Johann and Parada Jenny leg.; riparian forest; 16 Oct. 2018; Crbrt8; UPTC-In-00047.

Identification. This morphospecies can be distinguished from the other morphospecies of collected *Canthidium* by the presence of a cephalic carina with two projections in form of protuberances oriented towards the vertex; a strongly bidentate clypeus; pronotum smooth and finely dotted; body of dark gray–blue coloration (pers. obs.).

Distribution. This rare morphospecies accounted for

three individuals, which were found in the riparian forest between 850–1200 m a.s.l.

***Canthidium* sp. 4**

Figure 4D

Materials examined. COLOMBIA • 1, 7.29 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′38.68″N, 073°41′02.25″W; 1201 m a.s.l.; 25 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Bvpat6; UPTC-In-00048. • 4, 7.29 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir Farm; 04°08′40.92″N, 073°41′09.97″W; 1148 m a.s.l.; 14 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt8; UPTC-In-00049.

Identification. This morphospecies can be distinguished from the other morphospecies of collected *Canthidium* by the presence of a cephalic carina with two projections in the form of protuberances towards the vertex; a clypeus weakly excavated towards the apex; pronotum clearly dotted and shiny; elytra striae strongly marked (pers. obs.).

Distribution. This abundant morphospecies (106 individuals), was found between 850–1200 m a.s.l. in the riparian forest, high secondary forest and wooded grassland. However, there was a clear preference for forest habitats, especially in the riparian forest relics (92 individuals). Although they were observed in the wooded grassland, it is likely a route of passage or they were acting like "tourists", given their low abundance in this habitat (three individuals).

Dichotomius Hope, 1838

***Dichotomius boreus* (Olivier, 1789)**

Materials examined. COLOMBIA • 1, 27.91 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Loma" Farm; 04°08′26.69″N, 073°40′01.28″W; 730 m a.s.l.; 17 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Crpat3; UPTC-In-00050. • 3, 27.91 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′21.08″N, 073°40′08.76″W; 761 m a.s.l.; 30 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Crbrt5; UPTC-In-00051.

Identification. This species can be distinguished from other *Dichotomius* species by the head with transverse clypeal carina with or without lateral teeth and tritubercule vertex carina; pronotum with central protuberances in the form of almost square tubercles from which two small projections of the same size are projected on each (Sarmiento-Garcés and Amat-García 2014).

Distribution. In Colombia it is distributed in the departments of Guaviare, Meta and Vichada (Medina and Pulido 2009; Sarmiento-Garcés and Amat-García 2014). In the study area, it was recorded at 750 m a.s.l., higher than the one reported by Medina and Pulido (2009) and Sarmiento-Garcés and Amat-García (2014). Nine individuals were recorded, categorizing it as a rare species, in wooded pastures, secondary high forest and riparian forest cover.

***Dichotomius compresicollis* (Luederwaldt, 1929)**

Materials examined. COLOMBIA • 1♂, 12.59 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir Farm; 04°08′41.09″N, 073°40′46.38″W; 1172 m a.s.l.; 24 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt2; UPTC-In-00052. • 1♀, 12.59 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′21.08″N, 073°40′08.76″W; 761 m a.s.l.; 30 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Crbrt5; UPTC-In-00053.

Identification. This species can be distinguished from other *Dichotomius* species by the clypeus and gena with transverse roughness; the front edge of the head is triangular and margined; transverse carina at the base of the eyes; smooth pronotum and in some specimens with some punctation. In males there are small triangular tubercles towards the posterior angles of the pronotum and in females the tubercles are absent (Sarmiento-Garcés and Amat-García 2014).

Distribution. This species is distributed in the departments of Cundinamarca and Meta; between 200–1200 m a.s.l. (Medina et al. 2001), restricted to 200 m in the Colombian Orinoco region (Medina and Pulido 2009), although in the study area it was found between 700–1100 m a.s.l. It is a rare species represented in the sample by 17 individuals (scarce in museums and rare in field collections) but which were found representing all the habitats available with forest cover for the study: high secondary forest (nine individuals), riparian forest (three individuals) and wooded grassland (five individuals).

***Dichotomius mamillatus* (Felsche, 1910)**

Materials examined. COLOMBIA • 1♀, 23.74 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Loma" Farm; 04°08′28.18″N, 073°40′01.90″W; 730 m a.s.l.; 18 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Crpat3; UPTC-In-00054. • 1♂, 23.74 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′21.85″N, 073°40′12.19″W; 774 m a.s.l.; 17 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Crbrt4; UPTC-In-00055.

Identification. This species can be distinguished from other *Dichotomius* species by the head with transverse roughness in the clypeus, gena and frons, the presence of a short, thick and blunt horn at the height of the gena with two small horns adjacent to the base of the central horn; pronotum with two small protuberances in the anterior medial region (Sarmiento-Gárces and Amat-García 2014).

Distribution. The species is distributed in the Colombian and Ecuadorian Amazon, where it is a very well-represented species, extending to the foothills up to

1300 m a.s.l. (Sarmiento-Gárces and Amat-García 2009; Sarmiento-Gárces and Amat-García 2014). In the study area, it was observed between 750–850 m a.s.l. and seen in the habitats of riparian forest, high secondary forest, and wooded grassland, although it was rare species (59 individuals).

Dichotomius nisus (Olivier, 1789)

Materials examined. COLOMBIA • 1♀, 23.42 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′21.71″N, 073°39′40.81″W; 648 m a.s.l.; 15 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; open pasture; Crplt5; UPTC-In-00056. • 1♀, 23.42 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′24.39″N, 073°39′39.24″W; 648 m a.s.l.; 15 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; open pasture; Crplt3; UPTC-In-00057.

Identification. This species can be distinguished from other *Dichotomius* species by the head with transverse roughness, anterior edge of the clypeus margined with two rounded teeth, presence of a tubercle at the base of the eyes in the form of a large horn that is simple in males and small and forked towards the apex in females; pronotum strongly dotted with a vertical slope towards the anterior part, and a very conspicuous midline forming two small rounded protuberances (Sarmiento-Gárces and Amat-García 2014).

Distribution. In Colombia it is found in the Orinoco region, from the flatlands to sectors of the lowland foothills (Sarmiento-Gárces and Amat-García 2014). In the study area, it was observed between 650–700 m a.s.l. and detected only in open grassland habitat, so it is a rare species (seven individuals).

Dichotomius protectus (Harold, 1869)

Materials examined. COLOMBIA • 1♂, 22.61 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′37.17″N, 073°41′04.71″W; 1177 m a.s.l.; 11 Feb. 2019; Wooded pasture, Cárdenas Johann, Parada Jenny leg.; Bvpat6; UPTC-In-00058. • 2♂, 22.61 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′35.25″N, 073°40′50.28″W; 1122 m a.s.l.; 13 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt5; UPTC-In-00059. • 1♀, 22.61 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 4°08′40.92″N, 073°41′09.97″W; 1148 m a.s.l.; 23 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt8; UPTC-In-00060.

Identification. This species can be distinguished from other *Dichotomius* species, in the case of males by the head with transverse roughness and irregular granular punctation in the clypeus, frons and gena; clypeus with a horn that is flattened transversely; pronotum with strong flat and rough slope with transverse granules and with two small triangular horns towards the apical region of the slope. In females the head has a conical protuberance towards the vertex and frons region; pronotum with pronounced decline with four conical tubercles of equal size arranged transversely towards the apex (Sarmiento-Gárces and Amat-García 2014).

Distribution. This species is distributed in Colombia and Ecuador. In Colombia, it is found in the Eastern Cordillera up to 2500 m a.s.l., reaching the Magdalena Valley, the Orinoco region, and Amazonian foothills (Sarmiento-Gárces and Amat-García 2009; Sarmiento-Gárces and Amat-García 2014). In the study area, the species was found between 850–1100 m a.s.l., with a preference for wooded habitats (137 individuals) and sporadic records in open areas, such as wooded grassland (four individuals).

Dichotomius quinquelobatus (Felsche, 1901)

Materials examined. COLOMBIA • 2♀, 21.40 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′32.33″N, 073°40′48.44″W; 1095 m a.s.l.; 23 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt7; UPTC-In-00061. • 1♂, 21.40 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′21.08″N, 073°40′08.76″W; 761 m a.s.l.; 30 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Crbrt5; UPTC-In-00062.

Identification. This species can be distinguished from other *Dichotomius* species, in the case of males, by the head with transverse roughness of the clypeus and granular punctation in the frons and gena; clypeus with a transversely flattened horn; pronotum with a strong flat slope with marked punctation and roughness with five protuberances in the form of small horns located along the posterior margin of the slope, the central horn and the lateral ends are slightly larger than those near the central horn. In females, the head has a conical protuberance towards the vertex and frons region; pronotum with a pronounced declination towards the anterior medial region with two previously projected medial tubercles towards the apex and two smaller lateral ones (Sarmiento-Gárces and Amat-García 2014).

Distribution. This species is distributed in the Colombian Andes, in the three Andean cordilleras and is quite variable throughout its range, where the populations of the Eastern Cordillera are those that best match the description made by Felsche (1901) (see in Sarmiento-Gárces and Amat-García 2014). The species is found in Colombia between 500–2200 m a.s.l., consistent with the records of the species in the study area between 700–1200 m a.s.l. This abundant species was found to prefer forested habitats (330 individuals) and was found also in wooded grasslands (two records).

Dichotomius tristis (Luederwaldt, 1923)

Figure 3B

Materials examined. COLOMBIA • 1♀, 19.58 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las

Pesebreras" Farm; 04°08′21.30″N, 073°39′35.81″W; 630 m a.s.l.; 18 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; open pasture; Crplt8; UPTC-In-00063. • 3, 19.58 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′21.94″N, 073°39′50.27″W; 679 m a.s.l.; 28 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; CrPat7; UPTC-In-00064.

Identification. This species can be distinguished from other *Dichotomius* species, in the case of males, by the head with a trituberculate horn between the eyes basis and the gena. However, it can be distinguished to the others *D.* a*genor* species group mainly by the hypomeron setae arranged in a row (Santiago Montoya pers. comm., July 26, 2109).

Distribution. This species is distributed in Brasil and Venezuela (Vaz-de-Mello et al. 2014), but it occurs in Colombia as well. In Colombia, the species has been found in the Orinoco and Amazonian regions, probably between 100–2000 m a.s.l. For the study area, 124 individuals were found between 650–800 m a.s.l., distributed in wide areas of open grassland (86 individuals) and wooded grassland (35 individuals) and in forest cover such as in the riparian forest relics (two individuals).

Ontherus Erichson, 1847

***Ontherus kirschii* Harold, 1867**

Materials examined. COLOMBIA • 1, 11.88 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Triunfo" Farm; 04°08′44.51″N, 073°41′11.35″W; 1179 m a.s.l.; 22 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; open pasture; Bvplt8; UPTC-In-00065. • 1♀, 11.88 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′49.33″N, 073°41′05.32″W; 1174 m a.s.l.; 22 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt3; UPTC-In-00066.

Identification. This species can be distinguished from other *Ontherus* species by the head with the anterior edge slightly arched upwards and medially bisinuate; strongly roughened clypeus in males and females, clypeofrontal suture carinate with small conical processes towards the medial edges; uncrenulated elytra striae on the disc; middle lobe of the metaventrite usually with a few conspicuous long setae (Génier 1996).

Distribution. In Colombia it has been recorded in the departments of Boyacá, Cundinamarca, Meta, Norte de Santander, Putumayo and Valle del Cauca (Génier 1996). Records of specimen's collection in the country have been from 500 to 2500 m a.s.l. (Génier 1996; Medina et al. 2001), and in the Colombian Orinoco it is restricted to elevations between 1450 and 1750 m a.s.l. (Medina and Pulido 2009). In the study area, between 950–1100 m a.s.l., four individuals were found: two in riparian forest and two in open grassland areas. Due to its scarcity it was considered a rare species.

Scatimus Erichson, 1847

***Scatimus strandi* Balthasar, 1939**

Materials examined. COLOMBIA • 2, 6.84 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′39.48″N, 073°40′43.50″W; 1143 m a.s.l.; 26 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt4; UPTC-In-00067. • 2, 6.84 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′40.92″N, 073°41′09.97″W; 1148 m a.s.l.; 25 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt8; UPTC-In-00068.

Identification. This species can be distinguished from other *Scatimus* species by the head with frontal carina arched on the dorsal surface with the lateral ends previously directed; clypeus with two teeth in males and four teeth in females; mesepimeron lateral surface with transverse medial carina, and dotted anteromedial surface (Génier and Kohlmann 2003).

Distribution. The species is found in Ecuador and Peru (Génier and Kohlmann 2003; Chamorro et al. 2018). However, the species was reported in the lists presented by Escobar (2000), Medina et al. (2001), and Pulido-Herrera et al. (2007), indicating its presence Colombia. This contribution confirms its presence and contextualizes it in the Foothills–Andean forest strip on the eastern flank of the eastern Cordillera. In the study area, 71 individuals were recorded, associated only with the riparian forest (54 individuals) and high secondary forest (17 individuals); between 900–1200 m a.s.l.

Uroxys Westwood, 1842

***Uroxys* sp. 1**

Figure 3C

Materials examined. COLOMBIA • 1, 6.17 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′40.44″N, 073°41′05.84″W; 1201 m a.s.l.; 26 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Bvpat1; UPTC-In-00069. • 17, 6.17 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′42.33″N, 073°41′09.20″W; 1147 m a.s.l.; 24 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt7; UPTC-In-00070.

Identification. This morphospecies can be distinguished from the other *Uroxys* morphospecies collected by the head with bidentate clypeus; large and visible eyes (pers. obs.). This morphospecies shows a marked sexual dimorphism. Males have a developed medial angle of the pronotum margin; long and thin anterior tibiae; and elytra apex rounded forming a projection in developed males (pers. obs.). In females the medial border of the pronotum is not angled and the anterior tibiae are short and robust (pers. obs.).

Distribution. This morphospecies was found in riparian forest (46 individuals), high secondary forest (321 individuals), and included some sporadic records in

the wooded grasslands (three individuals). This was an abundant species in the study area and was found from 750 to 1200 m a.s.l.

Uroxys sp. 2

Figure 3D

Materials examined. COLOMBIA • 1, 5.19 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′40.44″N, 073°41′05.84″W; 1201 m a.s.l.; 11 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Bvpat1; UPTC-In-00071. • 7, 5.19 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′39.48″N, 073°40′43.50″W; 1143 m a.s.l.; 13 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt4; UPTC-In-00072.

Identification. This morphospecies can be distinguished from the other morphospecies of collected *Uroxys* by the head with quadridentate clypeus and slightly dotted pygidium (pers. obs.). *Uroxys* sp. 2, shows a marked sexual dimorphism, in males the anterior medial margin of the angled pronotum; long and thin anterior tibiae (pers. obs.). In females the anterior medial margin of the pronotum is rounded; short and robust anterior tibiae (pers. obs.).

Distribution. In the study area the morphospecies was found in habitats such as riparian forests (22 individuals), high secondary forests (79 individuals), and some sporadic records in the wooded pasture (one individual collected). This species was found from 750–1200 m a.s.l. in the study area.

Tribe Eurysterninii

Eurysternus Dalman, 1824

Eurysternus caribaeus (Herbst, 1789)

Materials examined. COLOMBIA • 4, 17.48 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′35.25″N, 073°40′50.28″W; 1122 m a.s.l.; 23 Dec. 2018; Cárdenas Johann and Parada Jenny leg., High secondary forest; Bvbt5; UPTC-In-00073. • 3, 17.48 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′42.33″N, 073°41′09.20″W; 1147 m a.s.l.; 23 Dec. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt7; UPTC-In-00074.

Identification. This species can be distinguished from other *Eurysternus* species by the posterior angle of the simple pronotum in males; metaventrite with two small longitudinal keels in its mid-basal part; posterior femur has a single tooth or tubercle in the posterior aspect, in some individuals an additional poorly developed tooth may appear near the base; in males the medial and posterior teeth of the anterior tibia is directed obliquely downwards (Génier 2009).

Distribution. In Colombia it has been reported from Amazonas, Caquetá, Cundinamarca, Guaviare, Meta and Norte de Santander; in areas from 0 to 3000 m a.s.l. (Génier 2009; Camero-R 2010), and at low elevations in the Colombian Orinoco region, between 100–350 m a.s.l. (Medina and Pulido 2009). Specimens have been observed associated with almost all the habitats of the Neotropical region (Génier 2009). In the study area between 700–1200 m a.s.l., 702 individuals of this abundant species were collected, both during the dry and rainy season. The high secondary forest was the most preferred habitat, represented by 328 individuals, followed by the riparian forest with 271, and to a lesser extent the wooded grassland where 99 individuals were recorded and four individuals were collected in open grassland.

Eurysternus foedus Guérin-Méneville, 1830

Materials examined. COLOMBIA • 2, 18.82 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Triunfo" Farm; 04°08′44.51″N, 073°41′11.35″W; 1179 m a.s.l.; 14 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; open pasture; Bvplt8; UPTC-In-00075. • 2, 18.82 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′37.17″N, 073°41′04.71″W; 1177 m a.s.l.; 11 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Bvpat6; UPTC-In-00076. • 4, 18.82 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Manigua" Farm; 04°08′18.17″N, 073°40′12.79″W; 816 m a.s.l.; 15 Feb. 2019; Cárdenas Johann and Parada Jenny.; High secondary forest; Crbt2; UPTC-In-00077.

Identification. This species can be distinguished from other *Eurysternus* species by the clypeus without strong dilatation in the middle part; pronotum with narrow margins near the anterior angle and has the width of regular margin; middle lobe of the sternum is covered by dots of regular size over the entire surface, dots are generally separated by several times their diameter with a thin bristle; the male's anterior tibia with a spur and in the females the posterior tibia without a tooth in the basal third of the internal border (Génier 2009).

Distribution. In Colombia, it has been recorded in the departments of Amazonas, Chocó, Guaviare, Meta, Norte de Santander, Santander, and Valle del Cauca (Génier 2009; Camero-R 2010). The species has been reported between 50–520 m a.s.l. (Medina et al. 2001; Génier 2009; Medina and Pulido 2009) and is associated with humid forests, primary and secondary forests, and highly degraded habitats (Génier 2009). In the study area, the species was found in all the sampled habitats (high secondary forest, riparian forest, wooded grassland and open grassland), between 700 to 1200 m a.s.l. It is a generalist species with greater representation in open areas of wooded grassland (153 individuals), open grassland (47 individuals), followed by areas with tree cover such as riparian forest (52 individuals) and high secondary forest with 50 individuals collected.

Eurysternus hypocrita Balthasar, 1939

Materials examined. COLOMBIA • 1, 21.06 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′49.33″N, 073°41′05.32″W; 1187 m a.s.l.; 23

Dec. 2018; Cárdenas Johann, Parada Jenny.; Riparian forest; Bvbrt2; UPTC-In-00078. • 3, 21.06 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′41.09″N, 073°40′46.38″W; 1172 m a.s.l.; 26 Apr. 2019; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt2; UPTC-In-00079. • 1, 21.06 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′21.52″N, 073°39′37.54″W; 648 m a.s.l.; 17 Oct. 2018; Cárdenas Johann and Parada Jenny; open pasture; Crplt4; UPTC-In-00080.

Identification. This species can be distinguished from other *Eurysternus* species by the head with small and faint punctation above, more evident towards the posterior part, vertex and the gena with simple, dense and deep punctation; lateral pronotal margin more or less sinuous near the anterior angle; smooth and shiny metaventrite (Génier 2009).

Distribution. In Colombia, it has been recorded in the departments of Amazonas, Caquetá, Guaviare, Meta, Nariño and Vaupés, where the species is associated with primary and secondary forests and floodable forest, in altitudes between 100 and 700 m a.s.l. (Génier 2009; Camero-R 2010). With 410 individuals collected in the study area, this abundant and generalist species was found in the four sampled habitats and during the two seasons of precipitation. Between 700–1200 m a.s.l., the riparian forest and high secondary forest harbored the greatest abundance of individuals (239 and 144 respectively), unlike the open areas of wooded grassland (26 individuals). Only one individual was collected in the open grassland at the lowest altitude.

***Eurysternus mexicanus* Harold, 1869**

Materials examined. COLOMBIA • 1, 11.22 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′24.60″N, 073°39′40.89″W; 648 m a.s.l.; 17 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; open pasture; Crplt4; UPTC-In-00081. • 1, 11.22 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′22.73″N, 073°39′22.73″W; 692 m a.s.l.; 10 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Crpat5; UPTC-In-00082. • 1, 11.22 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Manigua" Farm; 04°08′11.57″N, 073°40′13.86″W; 918 m a.s.l.; 15 Feb. 2019; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Crbt8; UPTC-In-00083.

Identification. This species can be distinguished from other *Eurysternus* species, by the pronotum with eleven more or less clear calluses, some of the calluses of the middle region are not very shiny; metaventrite with a foveolate in the middle in males; posterior aspect of the male metafemur has a small tooth located towards the middle, and in the females there may or may not be a tooth (Génier 2009).

Distribution. In Colombia it has been reported from Antioquia, Bolívar, Boyacá, Cesar, Magdalena, Meta, Norte de Santander, and Tolima (Génier 2009; Camero-R 2010). It is found in dry and humid habitats, both forest and open habitats (Génier 2009), at elevations between 100–1050 m a.s.l. (Medina et al. 2001). In the Colombian Orinoco region, the species is restricted to elevations between 200 to 600 m a.s.l. (Medina and Pulido 2009). This rare species was found between 700–900 m a.s.l. in the study area, and was represented by 17 individuals, predominantly open areas of wooded grassland (13 individuals), and less abundant in open grassland (three individuals) and in the high secondary forest (one specimen). The species was observed during times of both greater and lesser precipitation.

Tribe Onthophagini
Onthophagus Latreille 1802

***Onthophagus* gr. *clypeatus* Blanchard, 1843**
Figure 2B

Materials examined. COLOMBIA • 1, 6.48 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′40.44″N, 073°41′05.84″W; 1207 m a.s.l.; 25 Apr.2019; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Bvpat4; UPTC-In-00084. • 3, 6.48 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′42.33″N, 073°41′09.20″W; 1147 m a.s.l.; 13 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Bvbrt7; UPTC-In-00085. • 3, 6.48 mm (mean); Meta, Villavicencio, Vereda Buenavista, "El Porvenir" Farm; 04°08′35.25″N, 073°40′50.28″W; 1122 m a.s.l.; 12 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; high secondary forest; Bvbt5; UPTC-In-00086.

Identification. This species can be distinguished from other *Onthophagus* species by the prolonged clypeus on its anterior margin in the form of a "T", slightly bidentate in the females; males with slightly angled horns, variable in size towards the base of the eyes; females with two conical protuberances towards the base of the eyes; and pronotum with a pair of small tubercles towards the midline that do not extend beyond the anterior border (Zunino and Halffter 1997).

Distribution. It is distributed throughout almost the entire country in Colombia, according to collection records. However, some differences between these species were observed. In the study area the species were found in all habitats between 650–1200 m a.s.l., and were very abundant (1954 individuals). However, a preference was observed for areas with forested vegetation (riparian forest relics and high secondary forest) where 1695 individuals were collected with some specimens reported for open areas such as wooded grasslands (259 individuals) and only seven individuals in the open grassland.

***Onthophagus* sp. 1**
Figure 2C

Materials examined. COLOMBIA • 11, 6.37 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′24.60″N, 073°39′40.89″W; 648 m a.s.l.; 29 Apr. 2019; Cárdenas Johann and Parada

Jenny leg.; open pasture; Crplt4; UPTC-In-00087.

Identification. This morphospecies can be distinguished from the other species and morphospecies of collected *Onthophagus*, in the case of males, by the head without a marked front clypeal suture and with a smooth surface with angular horns of variable size; small eyes; clypeus widened towards the anterior margin; pronotum strongly dotted with bristles protruding from points; and anterior medial region of pronotum weakly or strongly convex (pers. obs.). In females, head with a marked front clypeal suture forming a small transverse carina and horns as conical protuberances towards the base of the eyes, in some females these protuberances are poorly developed and form a transverse carina towards the posterior border of the head; pronotum is strongly dotted with bristles emerging from each point; anterior medial region of the pronotum with two lateral projections (pers. obs.). Elytra interstriae are dotted with bristles at each point and are present in both males and females (pers. obs.).

Distribution. In the study area, this abundant morphospecies (770 individuals) was found between 700 m to 850 m a.s.l. with a preference for open areas of wooded pasture and open pasture (769 individuals).

***Onthophagus* sp. 2**

Figure 2D

Materials examined. COLOMBIA • 1, 5.42 mm (mean); Meta, Villavicencio, Vereda El Carmen, "Las Pesebreras" Farm; 04°08′21.52″N, 073°39′37.54″W; 635 m a.s.l.; 18 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; open pasture; Crplt2; UPTC-In-00088. • 1, 5.42 mm (mean); Meta, Villavicencio, Vereda El Carmen, "La Loma" Farm; 04°08′26.69″N, 073°40′01.28″W; 729 m a.s.l.; 17 Oct.2018; Cárdenas Johann and Parada Jenny leg.; wooded pasture; Crpat1; UPTC-In-00089. • 1, 5.42 mm (mean); Meta, Villavicencio, Vereda El Carmen, Caño Blanco–Caño Buque; 04°08′22.14″N, 073°40′15.77″W; 799 m a.s.l.; 16 Oct. 2018; Cárdenas Johann and Parada Jenny leg.; riparian forest; Crbrt2; UPTC-In-00090.

Identification. This morphospecies can be distinguished from the other species and morphospecies of collected *Onthophagus*, in the case of males, by the smooth surface of the head with horns of variable size towards the posterior margin; anterior region of the clypeus slightly projected forward; pronotum bright and dotted, with a vertical slope in the anterior margin (pers. obs.). In females, the head is marked with a front clypeal suture forming a small transverse carina; with or without conical horns towards the posterior edge of the head; and the pronotum is slightly stippled and shiny without vertical slope towards the anterior margin (pers. obs.). Elytra striae are marked; lightly dotted interstriae; dotted and hairy pseudo epipleuron (pers. obs.).

Distribution. This rare morphospecies was found sporadically throughout the area, with only 11 individuals in the riparian forest, high secondary forest and open grassland habitats.

Discussion

Medina and Pulido (2009) recorded 105 dung beetle's species for the Orinoco region and 84 species for the Andean foothills. The above review was the most recent found for the Orinoco region. Based on this total known for Colombia, the 35 species found in the sampled sectors of the Orinoco region were equivalent to 33.3% of recorded species and those recorded in the Andean foothills to 44.6% of the total recorded species. This dung beetle fauna is represented by lowland and midland features, reflecting the environmental heterogeneity of the study area in the transition zone of the foothills–Andean forest transition, between 650–1200 m a.s.l.

In addition to the extensions of altitudinal distribution, we noted that some species such as *Scybalocanthon* aff. *kelleri* although very similar to *S. kelleri*, have some differences that could be related with local population variations with respect to the revised material of CECC-CALT and the entomology collection of the Museo de Historia Natural "Luis Gonzalo Andrade"-UPTC. In addition to this, the distribution of this species is extended to the department of Boyacá, municipality of Santa María (850 m a.s.l.). These specimens are deposited in the entomology collection of the UPTC. Other important species was *Bdelyrus metaensis*, the record represents a more recent report for an area closely to the typical locality. Which opens the possibility of focusing studies on its real distribution, and degree of threat status.

There was a lack of taxonomic and systematic review of several genera of dung beetles, as well as distributional data, habitat commentary, behavior, and relationships between taxa. This information is of great importance, given that the lists of species and distribution maps are incomplete, causing errors for the construction of a baseline and subsequent decision-making in the territory. Bortolus (2008) found that many investigations in ecology do not take into account the clarity of the taxonomy of their work groups. This causes a series of errors for scientific knowledge, which have an impact on the actual management and conservation of biodiversity. On the other hand, the importance of deepening the knowledge of species, their distribution and different ecological attributes has also been recognized, since they are the basis for proposing new hypotheses in ecology, conservation biology, environmental management and decision-making in the territory (Thomson et al. 2018). In this way, taxonomic, systematic, and behavioral work, among others, should be encouraged. In Colombia and in the group of dung beetles it is necessary to emphasize on groups such as: *Canthidium*, *Canthon*, *Onthophagus*, *Uroxys*, *Ateuchus*, and *Scybalocanthon*.

Many of the groups that do not yet have systematic taxonomic reviews are highly diverse (González-Alvarado

Table 1. Species of dung beetles from Veredas El Carmen and Buenavista, Villavicencio, Colombia. Riparian forest relics (RFR), Secondary high forest (SHF), Wooded pastures (WP) and Open pastures (OP).

Subfamily	Tribe	Species	RFR	SHF	WP	OP	Total
Scarabaeinae	Deltochilini	*Anisocanthon villosus* (Harold, 1868)	—	—	1	54	55
		Canthon cyanellus Leconte, 1859	1	—	177	29	207
		Deltochilum (Deltohyboma) sp. 1	166	97	78	—	341
		Deltochilum guildingii (Westwood, 1835)	3	—	2	—	5
		Deltochilum orbiculare Lansberge, 1874	9	15	1	—	25
		Pseudocanthon sp. 1	—	—	—	1	1
		Scybalocanthon aff. *kelleri* Pereira & Martínez, 1956	4	—	—	—	4
	Phanaeinii	*Coprophanaeus telamon* (Erichson, 1847)	9	5	4	1	19
		Phanaeus cambeforti Arnaud, 1982	4	43	11	—	58
		Phanaeus haroldi Kirsch, 1871	3	—	25	16	44
		Sulcophanaeus auricollis (Harold, 1880)	1	—	—	—	1
	Ateuchiini	*Ateuchus* cf. *aenomicans*	10	16	33	1	60
		Bdelyrus metaensis Cook, 1998	1	—	—	—	1
		Canthidium sp. 1	379	348	10	11	748
		Canthidium sp. 2	28	151	8	1	188
		Canthidium sp. 3	3	—	—	—	3
		Canthidium sp. 4	92	11	3	—	106
		Dichotomius boreus Olivier, 1789	7	1	1	—	9
		Dichotomius compresicollis (Luederwaldt, 1929)	3	9	5	—	17
		Dichotomius mamillatus (Felsche, 1910)	48	4	7	—	59
		Dichotomius nisus (Olivier, 1789)	—	—	—	7	7
		Dichotomius protectus (Harold, 1869)	110	27	4	—	141
		Dichotomius quinquelobatus (Flesche, 1901)	93	237	2	—	332
		Dichotomius tristis (Luederwaldt, 1923)	3	—	35	86	124
		Ontherus kirschii Harold, 1867	2	—	—	2	4
		Scatimus strandi Balthasar, 1939	54	17	—	—	71
		Uroxys sp. 1	46	321	3	—	370
		Uroxys sp. 2	22	79	1	—	102
	Eurysterninii	*Eurysternus caribaeus* (Herbst, 1789)	271	328	99	4	702
		Eurysternus foedus Guérin-Méneville, 1830	52	50	153	47	302
		Eurysternus hypocrita Balthasar, 1939	239	144	26	1	410
		Eurysternus mexicanus Harold, 1869	—	1	13	3	17
	Onthophaginii	*Onthophagus* gr. *clypeatus* Blanchard, 1843	1190	505	252	7	1954
		Onthophagus sp. 1	1	—	130	639	770
		Onthophagus sp. 2	5	3	1	2	11
Total			2859	2412	1085	912	7268

and Medina 2015; Lopera-Toro et al. 2020). Several are under review and in the future, they will surely represent a large number of new species and records in different regions of the neotropics (Chamorro et al. 2018). In Colombia, the IAvH collection of coprophagous beetles from Colombia has carried out an initiative to unify registries at the national level. This consisted of the assignment of unique identification codes for the separation of morphospecies, resulting from the exhaustive review of the external morphology and genital organs, for later assigning to the generic name a number and the letter "H" (e.g., *Onthophagus* sp. 01H) (González-Alvarado et al. 2015).

Some research carried out in Colombia has already used this proposal to unify registries at the national level (González-Alvarado and Medina 2015; Murillo-Ramos et al. 2016; Vargas-Pérez and Martínez-Revelo 2016). In our research, several morphospecies could be unified under this coding, especially two of the *Canthidium* genus and two of *Onthophagus*. Although some researchers document that the use of "parataxonomic units" and morphospecies indiscriminately have direct effects on the overestimation of biodiversity (Krell 2004; Bortolus 2008). We considered it important to take into account these initiatives, which are supported by rigorous processes of revision of the external morphology and genitalia of the specimens, which would help to unify and subsequently replace the proposed single code with the specific epithet resulting from the concluded reviews.

The richness observed in this research indicates the great value of relictual riparian forests and secondary forests, which act as a reservoir of the remaining diversity. Escobar et al. (2007) point out that the intense transformation of natural habitats in the northern Andes, shaped a landscape of isolated forest fragments, which harbor, in many cases, a high species richness. This fact was verified in our study area and highlights the importance of forest relics for the conservation of assemblages in fragmented landscapes. There was a great difference observed in the richness values between the riparian forest and the secondary forest (31 and 23 species respectively). There was elevated richness in the wooded

grassland habitat, however, and it should be considered that these types of habitats can act as places of passage, given the shade provided by the trees. They support forest species to take advantage of certain food sources that may be available there. The richness of species that we found is similar to that recorded by Rangel-Acosta and Martínez-Hernández (2017). These authors evidenced that in certain transformed habitats, they can act as places of passage and movements of various species, even along the matrix. The open grassland clearly demonstrates the great loss of diversity that comes with this type of habitat transformation, allowing the establishment of an impoverished assemblage. The results that we show in this research form the basis for research proposals that seek to deepen the assessment of alpha and beta diversity and even functional and phylogenetic aspects of assemblies.

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Authors' Contributions

JSCB, JAPA and JECC conceived the idea and wrote the text. JSCB confirmed the taxonomic identity of all specimens. JAPA took and edited the photographs.

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